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ABSTRACT

The purpose of this paper is to help teachers develop a table of specifications for use in classroom testing. The common elements of tables of specifications are presented and explained. Special emphasis is placed on content-process validity. There are 12 tables of specifications in the appendix. The tables serve as examples and are representative of several curriculum areas over the K-12 spectrum. (Author)

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DEVELOPING A TABLE OF SPECIFICATIONS

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DEVELOPING A TABLE OF SPECIFICATIONS

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A Table of Specifications is the technical term given to the plan for writing items for a test. Just as a lesson plan is needed for organized teaching, a plan is needed for writing tests. The test blueprint or table of specifications should reflect what has been taught in the instructional sequence. In other words, the testing mode is a mirror of the instructional mode. Since the instructional mode has basically two dimensions - content matter and intellectual process, the testing plan should likewise reflect both content and process. By process we mean the intellectual level with which the student engages a specific content or unit of information. We can use the categories of Bloom's taxonomy to help define the process.

Let's backtrack a minute. We should not construct test items in a vacuum. Proceed with a plan which reflects not only what has been taught but also at what intellectual level students are functioning. Furthermore, the classroom test is an achievement test. All achievement tests should be content-process valid. Let's take time out to explain content-process validity. Validity is a term which can best be explained by the question,

"Does the test measure what it is supposed to measure." The term validity can also be equated somewhat with the term purpose. The content validity of a test means that the test items should be representative of the materials taught in class. In other words, there should be an adequate sampling of the domain of information presented in the instructional mode. How about an example? Suppose you teach a course called History of Civilization and your test consists of one essay question." Describe the events leading up to the First World War." That one essay question doesn't seem to represent the content of the course. This problem of adequately sampling content is a disadvantage of the essay format.

The process part of content-process validity means that the level of intellectual reasoning that we use in the instructional mode should find its way into the testing mode.

For example, if you never ask a synthesizing question in class (instructional mode), it's probably inappropriate to include a synthesizing question in the testing mode. If you require students to memorize facts most of the time (level 1, Knowledge of Bloom's Taxonomy) it's unfair to require students to apply information (Application, level 3 of Bloom's taxonomy) or to

integrate information (level 5, Synthesis of Bloom's Taxonomy) on a test.

The Table of Specifications is a two dimensional array (sometimes called a matrix). That sounds terribly technical but it's actually very simple. Look at any of the Table of Specifications in the Appendix of this module. One dimension is dedicated to content and the other dimension is dedicated to process. You will have also noticed that a Table of Specifications consists of one page which has a clear label.

The Table of Specifications specifies what items that the teacher must construct. Each cell of the matrix can specify a test item or test items. In other words, cells in the matrix get interpreted into test items identified by particular content at a particular level of intellectual reasoning (process).

It's a good idea for teachers to give a copy of the Table of Specifications to students. It is an outline of a sort which delineates what has been going on in the class instruction. Students can use the Table of Specifications as a study guide as well as a testing guide.

COMMON ELEMENTS

OF TABLES OF SPECIFICATIONS

1. One page outline.

2. Two dimensions

3. Indicate areas of emphasis by assigning weights

4. Usually nine to twenty cells

5. Not all cells need to be filled

LIST OF TABLES OF SPECIFICATIONS

FOUND IN THE APPENDIX

A Tests and Measurement - College Level

B Weather - Junior High School

C Social Studies - Third Grade

D Office Practice - High School

E Biology - High School

F Social Studies - Primary Grades

G Unit on Safety - Intermediate EMR

H English - Middle School

I Physical Geology - High School

J Music - Fifth Grade

K Algebra II - High School

L Home Economics - High School

There are twelve tables of specifications found in the appendix section of this paper. The tables are meant to serve as examples and they are representative of several curriculum areas over the K-12 spectrum. The reader is now encouraged to read through in cursory fashion the twelve tables.

There are several points of similarity. Notice that each of the twelve tables appears on only one typewritten page. There are two dimensions to each chart. One dimension is called content and the other dimension is called either process or objectives. It makes no difference whether the content dimension is on the vertical or horizontal axis. Also, the charts are partitioned into cells (anywhere from nine to twenty). The more technical name for this retangular arrangement is matrix. The cells of the matrix should include some indication of the relative weighting of that cell. In other words, what is the maximum number of points awarded for the correct response of information related directly to the cell. Let's look at an example. Turn to the chart for Junior High Test on Weather in Appendix B. Notice in the upper left hand cell the number 2. This indicates there are two

items in the area of knowledge of air pressure. There are five major areas of testing -

Air Pressure
Wind
Temperature
Humidity
Clouds.

Notice that the category of Wind is emphasized over the other four areas because it has sixteen items tallied into the last column. The entries in the final column (Total No. of Items) indicated the totals in each of the content areas. In this case there are fifty items scheduled.

Notice that not all of the cells need to be filled as in the case of the table of specifications in Appendix C. Also, the instructor should not feel bound to develop the exact number of items indicated for a cell. The table of specifications is a plan which is flexible. Many things can happen from the time a plan is set on paper until the time of implementation. By way of analogy, frequently a blueprint for building a house is not exactly followed. The cause for the change could be non-availability of a certain kind of material. In teaching a course, the instructor may be confronted with the non-availability of time which could occur because of any number of reasons - unexpected loss of time due to snow day, fire drills, teacher's strike, etc. Also, the instructor

should not feel bound to the exact number of items in a chart since the chart is meant to be an estimation.

There is one important difference in the twelve examples given in the appendix. Eight of the twelve (A, D, E, F, G, I, K, L) tables use a method of describing the content of each cell. The remaining four (B, C, J, H) simply indicate the number of items of each cell. The former method has the decided advantage of conveying more specific information to the student and therefore is a better study guide for the student. Furthermore, the instructor is likely to have an easier time writing items with the more descriptive method.

This brings us to the purpose of the table of specifications. The table should help the teacher write items for a test. The table specifies or prescribes the appropriate number of items in the appropriate content categories. Due attention is also given to the level of intellectional functioning. The table may also suggest to the instructor the format of the test item. For example, in Appendix L there is a cell which relates to knowing common terms such as the list of ten minerals given. A matching test containing eight to ten of these terms could easily be the way to

test for the information specified in that cell. The significant point is that the instructor develops test items to meet the requirements of each cell.

TABLE OF SPECIFICATIONS FOR TESTS & MEASUREMENT COURSE

CONTENT AREAS

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APPENDIX A

OBJECTIVES	Teacher Made Tests	Standardized Tests	Observational Techniques	
I. Recognizes Terms	Blueprint Difficulty Stem Option Sampling Content Validity Gagne' Guilford (5 items)	Achievement Aptitude Personality Buros Norms (4 items)	Sociometry Anecdotal Records Checklists Rating Scales Self-report inventories Criterion Reference Anchor points (6 items)	15 Items
II. Recalls Specific Facts	Functions of teacher made tests Adv. & Disadv. of item types Use of item analysis (5 items)	Age equivalent Grade equivalent Percentile Standard Score (6 items)	Adv. & Disadv. of anecdotal records Difference between checklist and rating scale Likert Scale Component Task Analysis (4 items)	15 Items
III. Recalls Generalizations and Principles	Method of preparing Blueprint Use of various item types Principles of item construction Improving reliability of essay tests (5 items)	Need for standardized tests Uses of intelligence test Validity Reliability (5 items)	Influences of various effects such as halo, Hawthorne, Barnum Improving anecdotal records Improving rating scales (6 items)	17 Items
IV. Applies Principles to Novel situations	Revises options and/or stems of poor items Identified errors in item construction Bloom's taxonomy (7 items)	Clear statement of Objectives Testing Measuring Evaluating (4 items)	Interprets results of Sociogram Can discriminate between product and process (2 items)	13 Items
	(23 items)	(19 items)	(18 items)	Total of 60 Items

TABLE OF SPECIFICATIONS FOR A JUNIOR HIGH TEST IN WEATHER

APPENDIX B

Content	Objectives						
	Knows		Understands	Skill in			
	Symbols and Terms	Specific Facts	Influence of Each Factor on Weather Formation	Use of Measuring Devices	Constructing Weather Maps	Interpreting Weather Maps	Total No. of Items
Air Pressure	2	3	3	Observe Pupils Using Measuring Devices (rating scale)	Evaluate Maps Constructed by Pupils (Check-list)	3	11
Wind	4	2	8			2	16
Temperature	2	2	2			2	8
Humidity and Precipitation	2	1	2			5	10
Clouds	2	2	1				5
Total # of Items Percent of Items	12 24	10 20	16 32			12 24	50 Items

TABLE OF SPECIFICATIONS FOR A THIRD GRADE SOCIAL STUDIES TEST (in percentage)

APPENDIX C

Content Area	Objectives					
	Knows Common Terms	Knows Specific Facts	Understands Principals and Generalizations	Applies Principles and Generalizations	Interprets Charts and Graphs	Total
Food	2	6	2			10
Clothing	2	6	2			10
Transportation	4	2	2	2	5	15
Communications	4	2	2	2	5	15
Shelter			5	5		10
City Life	4	2	6	8		20
Farm Life	4	1	6	8		20
Total	20	20	25	25	10	100

APPENDIX D

TABLE OF SPECIFICATIONS FOR A TWELFTH GRADE OFFICE PRACTICE TEST (in percentage)

Content Area	Objectives					
	Knows Common Terms	Knows Specific Facts	Understands Principals and Generalizations	Applies Principles and Generalizations	Interprets Charts and Graphs	Total
Typing	Type Vocabulary lists 2	Fill out Application Forms 4	Type letters pertaining to employment 4	Type reports on office jobs for English in Manuscript form 8	Type letters from transcribing machines 8	26
Machines	Telephone technique 2	Adding machines for problem solving 4	Make masters of application forms 8	Run off stencils of manuscripts 8	Use calculators to figure payroll 4	26
Record-keeping	File all permanent records, vouchers, and checks 2	Balance petty cash 2	Write checks for bills due for the month 8	Reconcile bank statement 8	Journalize transactions for the month 6	26
English	Compile Vocabulary list for various careers 4	Write to selected sources for information pertaining to careers 4	Write personal and business letters 8	English review in grammar 4	Explore Dictionary of Occupational Titles and other sources 2	22
Total	10	14	28	28	20	100

APPENDIX E

HIGH SCHOOL BIOLOGY

CONTENT AREA	OBJECTIVES					
	Knows Common Terms	Knows Specific Facts	Understands Process	Understands Principles & Generalizations	Applies Principles & Generalizations	Total
Plant and Animal Cells	3	3	2	1		9
Roots	4	4	3	2	2	15
Leaves	5	5	2	2	1	15
Photosynthesis	4	7	4	2	2	19
Flowers	6	3		2		11
Plant Reproduction	4	5	3	2	2	16
TOTAL	26	27	14	11	7	85

APPENDIX F

TABLE OF SPECIFICATIONS FOR FIRST GRADE SOCIAL STUDIES

CONTENT AREA	OBJECTIVES				
	Knows common terms	Knowledge of Classifications and Categories	Understands Generalizations	Applies Generalizations	Analyzes Relationships Various Neighborhoods
Neighborhood	Neighborhood, City Small Town	Distinguish between town and city living	Construct group collage. Decide which type of neighborhood and arrange accordingly. (Use pics of various settings).		
Transportation	Buses-Trucks Cars Airport Railroad	Distinguish between town and city transportation	Students will illustrate and label various forms of transportation in both city and town.		
Community helpers	Postman Doctor Dentist Businessman etc.	Cite functions and importance of community helpers	Students will construct booklet illustrating various community helpers and their function.		
Small Town Life	General Characteristics	Ability to describe aspects of small town life	Through use of an experience chart students will create a narrative description of small town and city living.		
City Life	General Characteristics	" same as above			
Town Merchants	store Storekeeper shop buy sell	Distinguish between large and small stores--dep't and grocery for example	Students will construct a collage-type department or grocery store--classifying articles accordingly.		

SAFETY UNIT
INTERMEDIATE EMR LEVEL

PROCESS

APPENDIX G

CONTENT AREAS	RECOGNIZES SURVIVAL WORDS	KNOWS SAFETY RULES	UNDERSTANDS REASONS FOR SAFETY RULES	APPLIES SAFETY PRINCIPLES AND GENERALIZATIONS THROUGH SKILLS	RELATES (INTERPRET SYMBOLS USED ON SAFETY SIGNS
PREVENTION OF ACCIDENTAL POISONING	1. Danger 2. Poison 3. Keep Out	1. Keep medicines out of children's reach. 2. Lable all bottles. 3. Separate Medicines and poisons. 4. Never gnaw on Paint. 5. Knows general first aid for poisoning.	Why have safety rules against taking Poisons? (To prevent Accidental death due to poisoning)	Makes up several empty bottles as "Mr. Uck" bottles and lable them as such under the name of the common household article.	Recognizes "Mr. Uc the new symbol for poisonous substanc Know the symbol it is replacing
WATER SAFETY	1. No Swimming 2. Lifeguard on/off duty 3. Shallow Water 4. Danger-Under Current, Deep Hole, etc. 5. Sudden Drop-Off	1. Never Swim Alone. 2. Swim where Lifeguard 3. Don't swim if overheated, tired, or after eating. 4. Deep Diving Area. 5. Swim Courteously.	What is the reason to follow water safety rules? (To prevent Drownings)	1. Demonstrates rescue techniques for a non-swimmer from the side of the pool. 2. Is able to put on life jacket correctly.	1. Knows that a RE flag means danger at a beach. 2. Recognizes sign for NO Swimming
FIRE PREVENTION	1. Combustible 2. Fire Extinguisher 3. No Smoking 4. Exit	1. Don't overload electric currents. 2. Keep matches out of children's reach. 3. Keep pot handles turned away from edge of stove. 4. Knows Fire escape routes at school.	Why Prevent Fire? (To save lives and valuables)	1. Locates nearest Fire Extinguisher at school. 2. Makes practice emergency phone call to report a fire. 3. Walks fire emergency route from classroom without assistance.	1. Recognizes that smoke is a sign of fire. 2. Recognizes sign for No Smoking
BICYCLE SAFETY	1. Stop 2. No Right Turn 3. No Left Turn 4. Yield 5. One Way 6. No Bicycles	1. Obey all Traffic rules and signs. 2. Keep to Traffic's right. 3. Have lights & Horn. 4. Yield to Pedestrians. 5. Watch out for cars. 6. Always ride 1 person to a bike. 7. Check your brakes.	Why follow Bicycle Safety Rules? (To prevent Accidents)	Demonstrates correct and safe technique for riding a bike by riding a course set up on the playground. A checklist will note all safety rules that were followed.	1. Is able to distinguish between hand signals. 2. Recognizes sign for No Bicycling Permitted.

APPENDIX H

TABLE OF SPECIFICATIONS FOR A SIXTH GRADE ENGLISH TEST (in percentage)

	Objectives					
PARTS OF SPEECH	Knows Definitions	Knows Correct Spelling Forms	Identifies Correctly	Follows Rules	Knows Correct Positions	TOTAL
NOUN	3	1	5	4	2	15
PRONOUN	3	1	4	2	2	12
ADJECTIVE	3	1	5	2	2	13
ADVERB	3	1	4	2	2	12
PREPOSITION	3		4	2	2	11
CONJUNCTION	3		4	2	2	11
VERB	3	1	5	4	2	15
INTERJECTION	3		4	2	2	11
TOTAL	24	5	35	20	16	100

APPENDIX I

TABLE OF SPECIFICATIONS FOR MID-TERM - PHYSICAL GEOLOGY - HIGH SCHOOL SENIOR LEVEL

CONTENT AREA	OBJECTIVES (PROCESS)			
	1. Recognized physical appearances and classification schemes.	2. Recalls specific internal composition and structural characteristics.	3. Recalls differences & similarities in related rocks and minerals.	4. Understands rock & mineral forming & the relationships
ROCK FORMING MINERALS	Specific Gravity Hardness, Luster Color, Cleavage	Atomic Structure Chemical Composition	Quartz, Feldspars Micas, Ferromagnisiums	Heat, Pressure Chemically precipitated Atmospheric Conditions
IGNEOUS ROCKS & IGNEOUS PROCESSES	Plutonic, Volcanic Texture, Shape Grain-size	Extrusive, Intrusive Mineral Composition Chemical Composition	Rhyelite-Granite Andesite-Diorite Basalt-Gabbre	Volcanic Erup. Glaciation Cooling Proces
SEDIMENTARY ROCKS & SEDIMENTARY PROCESSES	Stratification, Size of grains, Color, Fossilation, Ripple Marks, Mud Cracks, Cross-Bedding	Clastic, Non-Clastic Mineral Composition Chemical Composition Silieates Organic Deposits	Conglemerates, Sandstone Shale Mudstones	Continental Deposition Marine Deposition Glacial Deposition
METAMORPHIC ROCKS & PROCESSES	Foliated, Non-Foliated	Derivation Mineral Composition Chemical Composition Crystalline Structure	Hernfels, Slate Serpentine, Sehist Mylonite, Gneiss Marble, Quartzite Parent Rocks	Contact Metamorphism Hydrothermal Metamorphism Dynamic Metamorphism Regional Metamorphism Plutonic Metamorphism

APPENDIX J

TABLE OF SPECIFICATIONS FOR A FIFTH GRADE MUSIC TEST (IN PERCENTAGE)

Content Area	Objectives					
	Knows Specific Types	Understands basic concepts	Understands Usages	Interprets musical writings	Applies inter. to own music	Total
Folk Music	3	2	1	1		7
Musical instr.	5	3	5	2		15
Music Form	3	3		4	2	12
Rhythmic move.	3	3	2	3		11
Modes & Keys	5	3	2	6	4	20
Rhythm & Tempo	5	4	3	6	4	22
Dynamics	4	2	1	3	3	13
Total	28	20	14	25	13	100

APPENDIX K

TABLE OF SPECIFICATIONS FOR AN 11TH GRADE ALGEBRA II TEST

	OBJECTIVES				
Content Ares	Knowledge of Symbols and Math Terms and Concepts	Ability to Use Problem Solving Techniques	Skill in Computing	Ability to Graph	Ability to Interpret and Visualize Graphs
Polynomials	Variable Coefficient Define Polynomial Give Examples of a General Polynomial and Various Degree Polynomials	Division Algorithm Simplification Involving Parentheses and Brackets	Simple Addition, Subtraction Multiplication, and Division		
Functions and Graphs	$f(x) = y$ Independent Variable Dependent Variable Abscissa Ordinate Axes	Solving Linear Equations in Terms of a Variable	Given Function Determine Values of Function	Graph Simple 1st, 2nd, 3rd Degree Equations	Given Graph, Supply Appropriate Equation Given Equation, Give Description of Graph
Factoring Polynomials	Prime Polynomials Factor of a Polynomial	Techniques in Factoring 2nd-5th Degree Polynomials			
Multiplication and Division of Fractional Expressions	Reduction of Expression to Lowest Terms	Reduction of Expression by Factoring or by Reducing Exponents Before Actual Computation	Compute Answer		

APPENDIX L

TABLE OF SPECIFICATIONS FOR SENIOR HIGH SCHOOL HOME ECONOMICS

	Objectives			
Content Area	Knows Common Terms	Knows Specific Concepts	Understands Principals and Generalizations	Interprets Charts and Graphs
Vitamins	Vitamin A Vitamin B Vitamin C Vitamin D Vitamin E Vitamin G Vitamin H Vitamin K Vitamin M	Solvability Naming	Sources Recommended Allowances	Order of Development
Minerals	Calcium Iron Iodine Phosphurus Potassium Sodium Chlorine Flourine Magnesium Copper	Function	Sources Recommended Allowances	Chemical elements and percentages in human body
Carbohydrates	Monoaccharides Polyaccharides Diaccharides	Conversions Digestion Energy value	Sources Recommended Allowances	Classification of Carbohydrates
Fats	Oils	Comsumption Energy value Blood fats	Sources Recommended Allowances	Percentage of fats in typical foods
Proteins	Amino Acids	Nutritive quality Kwashiorkor	Sources Recommended Allowances	Essential amino acids
Water	Roughage	Solvent Retention Distribution in Body	Sources Recommended Allowances	Water balance of an average person